

ancient manners of nations now in the front ranks of culture.

The state of the savage mind as contrasted with that of the civilised man is well brought out in the following remarks by Col. Dodge as to what will and what will not astonish an Indian :—

"The Indian has actual and common experience of many articles of civilised manufacture, the simplest of which is as entirely beyond his comprehension as the most complicated. He would be a simple exclamation-point did he show surprise at everything new to him, or which he does not understand. He goes to the other extreme, and rarely shows or feels surprise at anything. He visits the States, looks unmoved at the steamboat and locomotive. People call it stoicism. They forget that to his ignorance the production of a glass bottle is as inscrutable as the sound of the thunder. A piece of gaudy calico is a marvel; a common mirror a miracle. He knows nothing of the comparative difficulties of invention and manufacture, and to him the mechanism of a locomotive is not in any way more matter of surprise than that of the wheelbarrow. When things in their own daily experience are performed in what to them is a remarkable way, they do express the most profound astonishment. I have seen several hundreds of Indians, eager and excited, following from one telegraph pole to another a repairer, whose legs were encased in climbing boots. When he walked easily, foot over foot, up the pole, their surprise and delight found vent in the most vociferous expressions of applause and admiration. A white lady mounted on a side-saddle, in what to the Indian women would be almost an impossible position, would excite more surprise and admiration than would a Howe's printing press in full operation" (p. 309).

Both Mr. Blackmore and Col. Dodge lament over the wanton destruction of the buffalo in the hunting-grounds of the Far West, where they are killed by tens of thousands merely for the value of their hides. On the Arkansas River, where the hunters had formed a line of camps, and shot the buffalo night and morning when they came down to drink, Mr. Blackmore found their putrid carcasses in a continuous line along the banks (p. xvii.). He reckons that in three years as many buffalo have been thus wastefully slaughtered as there are cattle in Holland and Belgium, and the map prefixed to the book shows the insignificant patches to which the buffalo ground, in 1830 extending across the whole middle of the continent, had shrunk by 1876. How recklessly the extermination was carried on may be judged from the description, at p. 137, of the "great buffalo-skinners's" method of using a waggon and horses to take the hide off the carcass at one pull, the ordinary method of careful flaying being found too slow. The destruction of the buffalo, driving the tribes of hunting Indians to starvation and revolt, has done much to hasten the extinction of this doomed race. But it is not the only cause of their destruction so swiftly going on. Every one who reads the details here given as to how the Indians carry on their war against the white settlers, must see that the whites will inevitably pursue the policy of killing them down till only a helpless remnant survives. But every candid reader will agree with Mr. Blackmore and Col. Dodge that it is the ill-treatment of the settlers, and the faithless disregard of Indian treaties by the American Government, that have made the warrior tribes into human wolves. It is evident that a humane while firm policy might have given the Indian tribes at least some generations of existence and well-being.

We English have much to reproach ourselves with as to the treatment of indigenous tribes, but in Canada these have not fared quite so ill as in the United States. Indeed, Mr. Blackmore shows by American testimony that the comparatively prosperous condition of the Indian tribes in the British possessions is due to our more just and kindly management of them. But their prospects look hopeless enough in such districts as Idaho, in United States territory, where the legislature could put forth the following proclamation of reward to men who go "Indian hunting" :—"That for every buck scalp be paid \$100, and for every squaw \$50, and \$25 for everything in the shape of an Indian under ten years of age."

Col. Dodge's chapter on "Travel" contains an interesting description of the branching ravines which intersect the table-land of the western plains, where valley-systems, with their numberless tributaries, often approach one another so as to be only separated by narrow "divides." Such a region presents interesting problems of valley-excitation to the geologist, but extraordinary difficulties to the path-finder, who, though his destination may be but a few miles off in the straight line, has to find and follow the divide, often in a circuitous track of as many leagues, that he may avoid a score of deep ravines which cut the ground between. Going up divides is easy enough, for they all must reach the principal, or summit, divide; but in going down, the one practicable divide has to be selected from hundreds which at the top look just as practicable to the waggoner, but only lead him, with his loaded wains, down upon the tongue of land in the fork of two steep ravines, where he must turn back and try again. Where there are buffalo, their trail marks the proper route, but otherwise the intricate maze can hardly be threaded except with the aid of an Indian guide or a perfect map. An account of these valleys, with a sketch like the author's, should find its way into every book on physical geography.

OUR BOOK SHELF

The Combined Note-book and Lecture Notes for the Use of Chemical Students. By Thomas Eltoft, F.C.S., &c. (London: Simpkin, Marshall, and Co., 1876.)

MR. ELTOFT is, we see from his title-page, engaged in teaching chemistry to two very large evening classes and also to the matriculation class at St. Bartholomew's Hospital, he has therefore very considerable experience as to the kind of instruction required by students going up for examination either to the University of London matriculation examinations, or to those of the Science and Art Department. His knowledge of the wants of the students has no doubt led him to the production of the "Note-book" we have before us; and we do not doubt that the system here followed will save the student much trouble otherwise incurred in wading through his own notes, so often ill arranged, and missing the salient points of the lecture.

The first twelve pages of the book following the index are occupied with a mass of useful memoranda, as we should prefer to call them, such as notes on formulæ, atomic weights, nomenclature, use of numbers, brackets, and signs, &c., in formulæ; the construction of constitutional formulæ, the base saturating power of acids, the density of gases, calculation of formulæ from analyses, and that tremendous crux with the ordinary student, the crith.

Of course the book is not intended for regular science

students such as attend the Royal College of Chemistry and other science schools, but rather for those who take up chemistry either as a branch of general education or as an evening study, and for this purpose it seems to be well fitted; at the same time there is the danger of cram to be guarded against. The author evidently feels this and has endeavoured to provide against it in a somewhat original manner. Pages 102-121 are divided into double columns, the left hand one on each page containing the preparation or reaction formulæ of one of the non-metallic elements and their more simple compounds; the right hand column is left blank, and the student is requested to note the conditions under which each substance is prepared either from the lecture or from a text-book. This device would if conscientiously carried out by the teacher, probably prevent cram of a certain sort, and compel the student to know a little more than the mere formula of a reaction or preparation. At the same time we must confess that we must still regard this knowledge as only another form of cram which is infinite in its varieties and made to suit the idiosyncrasies of each individual examiner, and which will exist as long as any form of knowledge continues to be looked on as something to "pass" an examination in; and as long as examiners continue to look only to a set of answers given on a certain day in a certain time to a particular set of questions, and not to the general character and capacity of the student. We therefore think that Mr. Eltoft will meet with failure in his well-meant effort; we trust, however, that he will continue to persevere.

The rest of the book is divided into double pages, meant for notes on particular elements, the pages being divided according to a scheme in which specific gravity, in the state of solid, liquid, or gas, colour, melting-point, and boiling-point, are successively considered. Another space is reserved for the description of the experiment, a third for sketches of apparatus, and a fourth for tests for the identification of the body. These pages will no doubt teach the student to systematise his notes to a very considerable extent and indicate to him a detailed method of observation.

In conclusion, we note that Mr. Eltoft, in his short preface, expressly states that his "note-book" is "not in any way supposed to take the place of a text-book, but to act as an adjunct to it." We regard it in this light as an honest effort to assist the large class of students for whom it is intended, and we hope that the author will watch the effect of the book on the classes he is teaching, look on his present effort as experimental, and come forward again with the aid of his increased experience to still further improve his work.

R. J. FRISWELL

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

Solar Physics at the Present Time

IN reference to Prof. C. P. Smyth's letter in NATURE, vol. xv. p. 157, I think it my duty to state that Prof. Smyth's remark on the priority of his exhibited results of observations of deep-sunk thermometers (as bearing on the question of transmission of waves of temperature into or from the interior of the earth) is perfectly correct.

It was only in the last summer that, having occasion to inspect some parts of Prof. Smyth's printed "Observations," I became acquainted with the extensive series of diagrams illustrating this matter. I have not yet been able to refer to his cited paper in the "Philosophical Transactions." G. B. AIRY

Royal Observatory, Greenwich, S.E.,
1877, January 1

Just Intonation, &c.

UNDER this heading your correspondent "A. R. C." while explaining Mr. Colin Brown's "natural finger-board," writes thus:—"The vibration numbers of the diatonic scale being represented by—

$$1, \frac{9}{8}, \frac{5}{4}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{15}{8}, 2.$$

If we build upon the dominant $\frac{3}{2}$, the vibration numbers will be—

$$1, \frac{9}{8}, \frac{5}{4}, \frac{45}{32}, \frac{3}{2}, \frac{27}{16}, \frac{15}{8}, 2,$$

and if we build upon the subdominant $\frac{4}{3}$ the vibration numbers will be—

$$1, \frac{10}{9}, \frac{5}{4}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{16}{9}, 2."$$

Unless "A. R. C." proposes some new system of tuning, I submit that he is in error in the first steps of his two examples. The dominant of C is G, and from G to A is a minor, and not a major, tone. Also the subdominant to C is F, and from F to G is a major, and not a minor, tone. I do not pursue the analysis, not desiring to criticise oversights, but to draw attention to a not uncommon misconception of the figures in the above scale, and to the general adoption of a miscalculation as to the so-called "Comma of Pythagoras."

An eminent mathematician, not long deceased, derived our diatonic scale from the one note F, by the following process:—"F A C—C E G—G B D," thus taking the common chords of three different keys. Had he followed out his system of adding on a new scale from the Fifth of the preceding, he would have gone the round of the keys, and have derived them all from F, which would have been the *reductio ad absurdum*.

Nothing can be clearer than the history of the scale, and it carries with it conviction of its truth. The octave was formed out of two Greek conjoined tetrachords, such as B C D E and E F G A, the E being common to both. Then the lower A was added at the bottom, to complete the octave, and it was called "the added note" (*proslambanomenos*) because it did not form part of any tetrachord. The reduction from the eight notes of the two tetrachords to seven is attributed to a superstition in favour of the number seven. Thus came our A B C D E F G A—a minor scale with a minor Seventh—and from it came our truer major scale, by commencing on the third note, C, but carrying with it all the imperfections of the double root of the original. No improvement has been made in the scale since the days when Archytas, the friend of Plato, introduced the consonant major Third, and Eratosthenes the minor Third. Our present scale is therefore absolutely anterior to the Christian era; the ratios of its intervals given by Greek authors prove the identity irresistibly. Let us then look to the figures which represent our scale as "A. R. C." has justly given them. The large 1 and 2 refer to C as the fundamental note and its octave. The 3 to 2, the 5 to 4, the 9 to 8, and the 15 to 8 represent octaves of the key-note (2, 4, or 8); but the 4 to 3 (the interval of a Fourth) and the 5 to 3 (the interval of a major Sixth) refer to C only as the so-called "Twelfth" above F, and not to C as the octave. If we play either of these two notes, F or A, with C, we cannot use C as a consonant bass. We must take F, and thus we have the old tetrachord system, with its double root, running in our present scale. In all keys the tonic and the subdominant are both necessary basses. F and A belong exclusively to F; but B and D have no relation to F, not being aliquot parts of the F string. They belong to the scale of C, but more intimately to that of G. The F string exceeds the length of the C string by 3 to 2, because its sound is that of a Fifth below C; therefore any attempts to bring the sounds of our scale to a common denominator are fallacious, the first law of Proportion being that "Ratio can subsist only between quantities of the same kind." Thus the "24, 27, 30, 32, 36, 40, 45, 48," cannot be accepted, because the 32 intended for the 4 to 3 of the scale, and the 40 for 5 to 3, represent other intervals. The 4 to 3 of C is the Fourth from C down to G, and the 5 to 3 of C is the major Sixth from E down to G. The 32 and 40 are not applicable to the interval of a Fourth from F down to C, nor to the major Sixth from A down to C.

And now as to the so-called "comma of Pythagoras," a strange name for the interval of 531441 to 524288! Can the modest inventor, who has concealed his own name, have supposed that the Greeks had musical instruments so very far